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COMMITTEE ON THE PEACEFUL
USES OF OUTER SPACE

IMPLEMENTATION OF THE RECOMMENDATIONS OF THE SECOND UNITED NATIONS CONFERENCE ON THE EXPLORATION AND PEACEFUL USES OF OUTER SPACE

International cooperation in the peaceful uses of outer space: activities of Member States

Note by the Secretariat

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* This document has not been formally edited.

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INTRODUCTION

1. In accordance with a recommendation of the Committee on the Peaceful Uses of Outer Space at its thirty-seventh session, Member States have submitted information on the following topics:[1]

(a) Those space activities that were or could be the subject of greater international cooperation, with particular emphasis on the needs of the developing countries;

(b) Spin-off benefits of space activities.

2. The information on those topics submitted by Member States as of 30 November 1994 is contained in document A/AC.105/592; the information submitted between 1 and 31 December 1994 is contained in document A/AC.105/592/Add.1; the information submitted between 1 and 27 January 1995 is contained in document A/AC.105/592/Add.2; and the information submitted between 28 January and 6 February 1995 is contained in document A/AC.105/592/Add.3.

3. The present document contains information submitted by Member States between 7 and 10 February 1995.

[1] *Official Records of the General Assembly, Forty-ninth Session, Supplement No. 20* (A/49/20), para. 29.

REPLIES RECEIVED FROM MEMBER STATES

POLAND

[Original: English]

The Committee on Space Research of the Polish Academy of Sciences coordinates the activities of the institutions in Poland engaged in the field of space research and applications. This activity is connected to international programmes and bilateral agreements of Poland and other countries.

This report presents some results of space activity in Poland in the field of space physics, satellite geodesy, remote sensing and space biology and medicine in 1994.

1. Space physics

Polish activities in this field have been concentrated in the following directions:

- Participation in space missions;
- Design and construction of scientific equipment in space physics;
- Processing of data obtained from previous and current space experiments; and
- Theoretical investigations aimed for interpretation of observational results in the field of space physics.

2. Space mission

Recently, space physicists in Poland have been participating in an international space project, namely CORONAS-I, launched from a Russian cosmodrome on 2 March 1994. The spacecraft, operated by the Institute of Terrestrial Magnetism and Wave Propagation (IZMIRAN) is devoted to the study of the solar corona. Its main goal is to observe solar flares in various spectral ranges so as to improve our understanding of flares and the disturbances which they induce in the corona. Two Polish instruments have been installed on board:

- The X-ray spectrometer (DIOGENES); and
- The radio-spectrometer (SORS).

The latter is aimed at the study of solar radio emissions in the range from 100 kHz up to 300 MHz. Analysis of the data from these instruments is currently under way.

3. Hardware for future experiments

Development of instrumentation for several international projects is currently being continued in Poland. The projects to which Poland contributes and the instruments provided are:

- INTERBALL and MARS (coordinated by Russia): radio frequency spectrum analysers to study plasma wave generation and propagation in the magnetospheric plasmas of the Earth and Mars;
- CORONAS-F (coordinated by the Russian Federation): Solar X-ray photometer RESIK;
- RELICT-2 project (coordinated by the Russian Federation): engineering models for GAZ-E and GAZ-GSE have been built. The development of the plasma wave analyser is in progress;
- The joint ESA/NASA CASSINI mission: the Thermal Properties meter (THP) which is a part of a British Surface Science Package experiment. The package will be installed on the HUYGENS lander to Titan, one

of Saturn's moons, to measure temperature and thermal conductivity of gases and liquids in Titan's atmosphere and ocean;

- CESAR (Central European Satellite for Advanced Research): contribution to the construction of the satellite and development of experiments aimed to measure fluctuation in the frequency range 20 Hz-20 MHz and monitoring of the thunderstorms in the ionosphere.

4. Data processing and interpretation

Poland's contribution to processing and analysis of space data is as follows:

- Continued processing and interpretation of data from AKTIVNY and APEX ionospheric missions, Prognoz-8 and AMPTE-UKS magnetospheric missions;

- Cooperation in data interpretation of 2-3 kHz emissions recorded by plasma wave instruments on the deep space Voyager mission;

- Use of X-ray data from the Solar Maximum mission for investigations of flare heating, plasma motions in flares and chemical composition of flare plasma;

- Data processing and interpretation of the ULYSSES-GAS experiment for all in-ecliptic scenarios;

- Application of the inverse (tomography) method to optical observations of the Io torus (the moon closest to Jupiter).

5. Main results

- An original approach has been developed, based on the kinetic theory, to study the physical evolution of the short-period comet population. Results have been presented at the Cometary Conference in Mariehamn, held in August 1994.

- Analysis of the cosmic ray modulation in the last solar cycle led to evidence of a connection between hysteresis loops of this modulation and the so-called Global Merged Interaction Regions, which propagate in the heliosphere.

- Longitudinal electron heating (up to 180 eV) has been discovered in the "pileup" region outside the Earth magnetopause, when the interplanetary magnetic field is directed to the north. The heating is so strong that the electron temperature outside the magnetopause is directly higher than in the boundary layer of the magnetosphere. The heating is accompanied by plasma waves.

- New phenomena on the magnetospheric flank during development and expansion of a sub-storm have been described. One is a deep penetration of plasma from the boundary layers into the interior of the magnetosphere, during "stretching" of magnetic field lines, and the second is a pulsating character of "discharge" of an intensive transversal current in the tail.

- Radio noises detected by wave experiments aboard the VOYAGER mission around dust rings of Saturn and Uranus have been interpreted as a reaction of the antennae to plasma clouds generated by dust impacts.

- The tomographic method has been developed to process many data sets together. As a result, more accurate values of the interstellar neutral He parameters have been determined.

- The study of the ULF/ELF plasma waves associated with small-scale structures in the vicinity of the Earth's bow shock and magnetopause have been done.

6. International cooperation

- International Workshop on Space Plasma Physics organized by the Commission of Space Physics in the Committee on Space Research, 28 February 1994, Warsaw.

- Meeting with ESA representatives organized by the Polish Committee on Space Research, devoted to presentation of proposals for cooperative studies with ESA partners on 4 May 1994 in Warsaw.

- Meeting with the National Ukrainian Space Agency representatives on cooperation between the agency and the Polish Committee on Space Research on 2 December 1994 in Warsaw. An agreement in which cooperation in space physics is included was signed (themes: solar physics, the planetary system, space plasma, astrophysical observations, launches of spacecraft).

7. Space research centre

All the activities presented above are conducted by the Space Research Centre in Warsaw and in its branch, the Solar Physics Division in Wroclaw.

8. Satellite geodesy

8.1 Geodetic network

Probably the most important achievement in civil application of GPS in Poland during the last year was the accomplishment of the zero order geodetic network, EUREF-POL, becoming part of the all European EUREF network. Eleven points were established in the Poland and they are adjusted to the earlier existing part of the network in Germany as well as to fiducial stations in other countries. The average accuracy was approximately 1.5 cm in the horizontal and 2.5 cm in the vertical direction. These results were presented at the International Symposium on European Reference Frame, which was organized in Warsaw, 8-12 June 1994 and was attended by about 80 participants from almost all European countries.

Presently the follow-up of the EUREF campaign is under way: namely the first order geodetic network POLREF (POLish REFerence network). It will consist of approximately 500 points with an inter-station distance of 25-30 km. One fourth of the network has just been measured and the rest will be observed this autumn and next year.

This work is carried out by the Geodetic Department of the Research Centre of the Polish Academy of Sciences.

8.2. Geodynamic research

Poland participates actively in the International Geodynamics Service programme and geodynamics research. Three permanent stations are conducting GPS observations. The stations are located at Jozefoslaw, Borowiec and Lamkowo, the first being part of the IGS CORE network. A number of international geodynamic projects like the Baltic Sea Level Project, Geodynamic Profiles in Central and Southern Poland (SAGET), Extended SAGET, CERGOP (Central European Geodynamic Project) are being conducted. The satellite laser ranging station at Borowiec is operating continuously and satellites with retroreflectors such as LAGEOS-1 and -2, STARLETTE, STELLA, ERS-1 and TOPEX/POSEIDON are permanently tracked. The station takes part in NASA's Dynamics of the Solid Project as well as in the International Earth Rotation Service.

8.3. Differential GPS

Experiments in DGPS are being conducted for maritime navigation. Two different systems are currently under test and user experience is being gathered. It is expected that at least one DGPS station will begin routine operations next year.

8.4 Instrument development

In the field of instrument development the new GPS hand-held receiver NAVI T04 has been developed by the consortium POLSPACE Ltd. The receiver determines time, position, velocity and delivers navigation data. It is dedicated to low accuracy applications such as sailing, fishery or forestry and topographic orientation. First units delivered by the producer are in the testing stage.

9. Remote sensing activity

The activity in remote sensing has been conducted in the Institute of Geodesy and Cartography, Institute of Meteorology and Hydrology in Cracow and in the Space Research Centre in Warsaw.

The Remote Sensing and Spatial Information Centre of the Institute of Geodesy and Cartography is using remote sensing data for thematic mapping, elaboration of image satellite maps and including these data and maps into geographical information systems with different orientations. The following works should be ranked as one of the most important in 1994 to the stratification of Polish territory based on satellite photographs as a source of multi-purpose studies of the environment. Satellite image maps for the selected region in central Poland have been prepared. Satellite photographs were interpreted in order to delineate homogenous land cover types. A digital database has been created in the course of these works; it comprises satellite images, their interpretation and digitized agricultural suitability maps. This activity is the preparatory phase for the realization of the MARS Programme-Regional Inventories, sponsored by CEC (Commission of the European Community), to be realized in 1995.

9.1. Satellite remote sensing for monitoring forest decline

A classification map for the selected test area in Sudety Mountains has been prepared. Several classification approaches, characterized by different detail of analysis were tested. As a result of these works, conclusions concerning accuracy of forest classification on the basis of Landsat TM images were drawn. This activity is the first stage of the joint Polish-American programme aimed at the use of satellite remote sensing for forestry, sponsored by the Polish-U.S.Maria Curie-Sklodowska Joint Fund.

9.2. Space map of Poland

The space map of Poland is a mosaic of 28 images acquired by Landsat Multispectral Scanner in the period 1975-1981. The final image of scale 1:1,500,000 has been transformed into a map in Albers conical projection.

The main topics addressed in the meteorology area by the Institute of Meteorology and Hydrology in Cracow are:

- The nowcasting method of preparation from Meteosat satellite data, calibrated by radar data;
- The method of cloud type automatic classification and estimation of precipitation intensity from Advanced Very High Resolution Radiometer (AVHRR) data;
- Analysis of error for the total ozone amount derived from Total Ozone Mapping Spectrometer (TOMS) measurements and transformation of total ozone content fields into a regular geographical grid;
- The method and implementation of satellite derived sea surface temperature and ice cover for the Baltic sea.

The Department of Remote Sensing in the Space Research Centre of the Polish Academy of Sciences concentrates its activity primarily on fundamental research in the field of sounding the planetary atmospheres by passive optical methods. Currently the Department is engaged in preparing for the following missions:

- Investigation of trace gases and aerosols in the terrestrial atmosphere with the use of the IR spectrophotometer, Istok-1, to be placed on board the Russian space station MIR. The experiment is being prepared by an international team. The Polish segment of the programme comprises studies of the

concentration and spatial distribution of trace gases. Construction work carried out in the Department comprises designing and building of the digital VIS TV camera and tester, named VIZIR, coupled to the spectrophotometer. Launch is planned for the autumn of 1995;

- Investigation of the Martian atmosphere and gas/dust area presumably surrounding the planet along the orbits of its moons Phobos and Deimos with the aid of an IR Fourier Spectrometer during the interplanetary mission MARS-1. The experiment is also being prepared by an international team. The Polish part of the scientific programme currently comprises modelling of measurements of the gas/dust area along the orbits of Phobos and Deimos and modelling of abundances of minor constituents in the Martian atmosphere. Construction work carried out in the Department comprises designing and building of the on-board power supply and comparable testing with similar systems ordered by CNES, ESA or NASA for experiments in space. Launch of MARS-1 is planned for the autumn of 1996;

- Preparatory phase of the studies of the trace gases and aerosols in the terrestrial atmosphere with the aid of the IR Fourier Spectrometer of medium spectral resolution from on board the small satellite CESAR (Central European Satellite for Advanced Research) to be built by a team of scientists and technicians of the countries of the CEI (Central European Initiative). Launch is planned for 1997.

The Department is also constructing passive microwave radiometers for ground-truth measurements in the frequency ranges of 5, 12 and 20 GHz to calibrate SAR pictures taken from ERS-1.

In the domain of applied research the staff of the Department is experienced in the construction of high quality, ground-based field spectrophotometers for monitoring atmospheric pollution and also for agricultural purposes.

10. Space biology and medicine

Basic research in the field of space biology and medicine was focused on the biological effects of microgravity.

Biological samples collected during the 13-day mission of the Cosmos 1817 biosatellite were used for analysis. The ultrastructural morphometric analysis of rat adrenal gland cells had revealed changes in the medullar and cortical sites, suggesting the increased activity of this organ in microgravity conditions.

Research on the possible role of myoblast cells (also called the satellite cells) in the complex mechanisms of degeneration and regeneration of muscle fibres evoked by hypokinesia and weightlessness was also continued. Earlier investigations (*Postepy Astronautyki*, 1991) had shown that in the microgravity state, changes are observed in these cells that may be interpreted as the lowered regeneration ability of the damaged muscle fibres.

Work also continued on the refinement of LBNP (Lower Body Negative Pressure) techniques aimed at application in spaceflight for compensation of weightlessness induced perturbations of blood circulation and also in the post-flight period to aid the readaptation to normal (Earth) gravity. Effort was made to improve the experimental system, which in a programmable way generates the LBNP stimulus and the methods of evaluation of the adaptive capacity of the cardiovascular system.

The experiments based on the LBNP system were performed for a better understanding of the physiological mechanism involved in the compensatory reaction to variable gravity. Special attention was paid not only to haemodynamic but also to relevant hormonal mechanisms.

The method for extraction of ionizing radiation components with high LET factor was also developed. The measurement technique of the neutron component of radiation generated by charged cosmic radiation particles in the Earth atmosphere was developed and verified experimentally.